Establishing Large, Multiple-use Marine and Coastal Protected Areas in the San Andrés Archipelago, Colombia

CHERI A. RECCHIA[1] and JUNE MARIE MOW[2]
[1] *The Ocean Conservancy*
1725 DeSales St. NW, Suite 600
Washington, DC, 20007, USA
[2] *Coralina*
San Luis Road, Bight
San Andrés Island, Colombia

ABSTRACT

Colombia's Archipelago of San Andrés, Old Providence and Santa Catalina lies in the southwestern Caribbean. At some 300,000 km^2, it comprises nearly 10 % of the Caribbean Sea. Declared the Seaflower Biosphere Reserve by UNESCO in November 2000, the Archipelago contains some of the most intact ecosystems in the region, as well as populations and habitats degraded by unsustainable practices. CORALINA, the regional autonomous government agency responsible for the sustainable development of the lands and waters of the Archipelago, is establishing extensive protected areas to conserve biodiversity, promote community stewardship and sustainable use of coastal and marine resources, protect traditional uses of marine resources by the native community, and enhance the equitable distribution of social and economic benefits among residents. The three planned marine and coastal protected areas collectively cover over 40,000 km^2 and include the three inhabited islands and surrounding reef systems, as well as various banks, cays and atolls, including important fishing areas for both residents and foreign vessels. The most intensively used waters of the protected areas will be zoned to include no-entry areas, no-take areas, dedicated artisanal fishing areas, general use zones, and special use zones. CORALINA and partners have collected biological and socioeconomic data to inform the design of the protected areas. Extensive consultation and collaboration with key stakeholders have been features of the project since its inception. Mechanisms for financing the protected areas system were evaluated to cover the operating costs, estimated at USD $350,000 annually. Additional international mechanisms to increase the effectiveness of the protected areas are being considered, including a proposal to the International Maritime Organization to designate a Particularly Sensitive Sea Area (PSSA).

KEY WORDS: Biosphere Reserve, marine protected area, San Andrés

Establecimiento de Grandes Áreas Marinas Protegidas de Utilización Múltiple y Áreas Costeras Protegidas en el Archipiélago del San Andrés, Colombia

El Archipiélago se encuentra en el sector suroccidental del Mar Caribe y incluye un área marina de 300,000 km^2, que equivale aproximadamente al 10 % del Mar Caribe. Declarado "Reserva de Biosfera Seaflower" por UNESCO en Noviembre 2000, el Archipiélago se caracteriza por poseer ecosistemas insulares intactos comparados con el resto de la región a pesar de la presencia de asentamientos humanos y hábitats degradados debido a prácticas poco sostenibles. CORALINA, la agencia gubernamental autónoma, responsable del desarrollo sostenible de los suelos y el mar del archipiélago, está planificando y estableciendo extensas áreas marinas protegidas para conservar la biodiversidad, promover prácticas sensatas para garantizar el uso sostenible de los recursos costeros y marinos, proteger los derechos que se refieren a los usos tradicionales de la comunidad nativa, promover mediante la educación un mayor sentido de pertenencia y distribuir equitativamente los beneficios sociales y económicos para contribuir al desarrollo local. Las tres áreas marinas protegidas que conformarían el Sistema Regional de Areas Protegidas cubren mas de 40,000 km^2 y abarcan las tres islas habitadas y sus arrecifes circundantes, así como los bancos, cayos y atolones asociados y varias zonas de pesca importantes tanto para comunidades nativas como para empresas pesqueras nacionales con embarcación es nacionales y extranjeras. Las aguas mas intensamente utilizadas serán zonificadas para uso múltiple; habrán zonas a las cuales se prohibirá su ingreso, zonas en las cuales se prohibirá la extracción de recursos, zonas dedicadas exclusivamente a la pesca artesanal, zonas de uso general, y finalmente zonas de uso especial. CORALINA y sus pares han recolectado datos biológicos y socioeconómicos con el fin de orientar el diseño de las áreas protegidas. Un aspecto esencial aún desde el inicio del proceso ha sido la colaboración y consulta de CORALINA con los grupos de interés (stakeholders). Los mecanismos para financiar los costos de operación, estimados en US$ 350,000 anuales, del Sistema Regional de Areas Protegidas se están evaluando. Además, se están estudiando mecanismos internacionales adicionales para aumentar la eficacia de las áreas protegidas, incluida una propuesta ante la Organización Marítima Internacional, OMI (International Maritime Organization, IMO) para designar Áreas Marinas de Susceptibilidad Especial (Particularly Sensitive Sea Area, PSSA).

PALABRAS CLAVES: Área marina protegida, reserva de biosfera, San Andrés

INTRODUCTION

Colombia's Archipelago of San Andrés, Old Providence and Santa Catalina lies in the southwestern Caribbean, approximately 130 miles east of Bluefields, Nicaragua; 450 miles south of Grand Cayman; and 500 miles west-northwest of Cartagena, Colombia. The Archipelago comprises three small, inhabited islands and several uninhabited cays with a total insular area of 57km^2 and a marine territory of approximately 300,000 km^2, covering nearly 10 % of the Caribbean Sea (CORALINA 2000a). The Archipelago's coral reef ecosystems are among the most extensive in the Caribbean; the barrier reef off the islands of Old Providence and Santa Catalina alone is 32 km long and covers an area of 255 km^2, making it one of the largest true barrier reefs in the Americas (Geister and Diaz 1997).

Declared the Seaflower Biosphere Reserve by UNESCO in November 2000, the relatively isolated Archipelago includes some of the least degraded habitats in the Caribbean (Appeldoorn et al. 2003a, Friedlander et al. in press, Friedlander et al. in prep). However, the 25 km^2 island of San Andrés, with an estimated population of over 80,000, is the most densely populated island in the wider Caribbean region, with at least 2,442 inhabitants per km^2 (CORALINA 2000b). The Archipelago's waters are fished by residents and by vessels from mainland Colombia, central America, various Caribbean nations, and occasionally the U.S. Near-island habitats in particular show the effects of pollution, nutrient enrichment and sedimentation from inadequate waste management and land-use practices, and invertebrate and reef fish populations throughout the Archipelago show clear signs of overfishing, particularly of queen conch (*Strombus gigas*), spiny lobster (*Panulirus argus*), and groupers, including Nassau groupers, *Epinephelus striatus*, and black groupers, *Mycteroperca bonaci* (CORALINA 2000a, 2000b, Dahlgren et al. 2003, Friedlander et al. in prep).

To address these and other issues, CORALINA, the local representative of the Colombian National Environment System and the agency responsible for the sustainable development of Archipelago's lands and waters, developed a four-year project, funded by the Global Environment Facility (GEF), to establish a system of multiple-use marine protected areas (MPAs). Under the GEF project, now in its final year, CORALINA has focused particularly on data collection and analysis, stakeholder engagement, designing the MPAs, and MPA financing options.

MPA PROJECT ELEMENTS

Stakeholder Engagement

Stakeholders, defined as users of the marine environment, were identified and characterized. Education and outreach were conducted via different venues (e.g., church, community and neighborhood association meetings), media (e.g., television, radio) and materials (e.g., calendars, posters), depending on the group involved. For example, a key sector of the population is the native islander community, a constitutionally protected minority of Anglo-

African heritage that is racially and culturally distinct from the majority, who are immigrants from mainland Colombia (Howard et al. 2003). The three main objectives were:

i) To educate stakeholders about the marine environment, threats to marine ecosystems and the MPA project;
ii) To build support for the MPAs; and
iii) To monitor perceptions and opinions about the project.

For fishermen and marine tourism operators, stakeholders who will be most directly affected by the MPAs, a consultation structure was developed and implemented. They were consulted regularly on many aspects of the project, including the preferred objectives for the MPAs and design considerations.

Ecological Assessments

CORALINA partnered with The Ocean Conservancy, a U.S.-based non-governmental environmental organization, to conduct ecological assessments of the four most intensively used areas of the Archipelago: the waters surrounding the main island of San Andrés; those surrounding the other two inhabited islands, Old Providence and nearby Santa Catalina; Southwest and East Southeast Cays, south of San Andrés Island; and Quitasueño, Roncador and Serrana Banks, north and east of the inhabited islands (Figure 1). The southern banks are important fishing grounds for local artisanal fishermen, and the northern banks for both artisanal and industrial fishing.

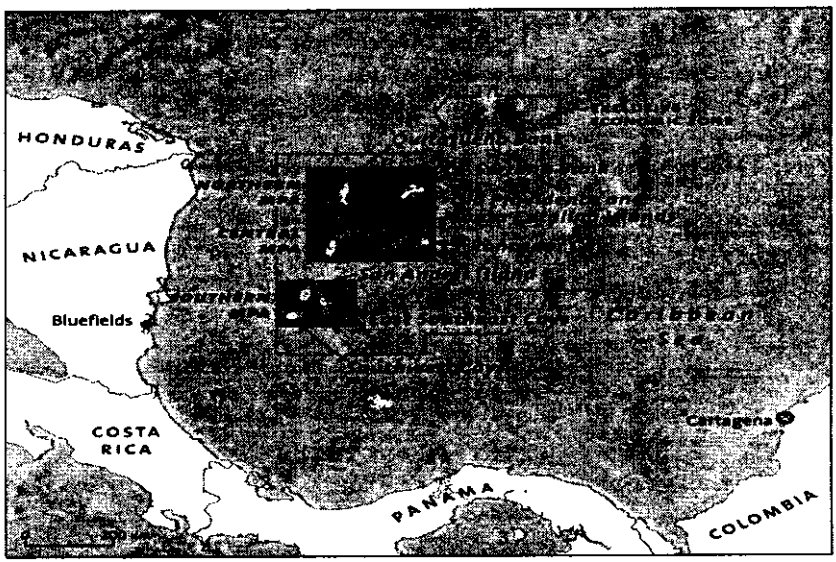

Figure 1. The Archipelago of San Andrés, Old Providence and Santa Catalina includes three inhabited islands and cays and banks to the north and south that are important fishing grounds. The planned MPA system covers over 40,000 km^2 and comprises 3 areas: northern (23,512 km^2), central (9,077 km^2), and southern (8,930 km^2).

In each area, biologists assessed the status of coral reefs and associated species, evaluated coral health, characterized major habitat types, and described the distribution and abundance of key species, including conch, spiny lobster, and reef fish. A primary purpose of the assessments was to inform MPA zoning, particularly the identification of possible areas to be closed to fishing. Other purposes included identification of locations of particular conservation concern, including significant stands of live elkhorn or staghorn corals (*Acropora* spp.), and collection of baseline (pre-MPA) data to support monitoring and performance evaluation of the MPAs once established.

In addition, ecological information was gathered from Archipelago residents, particularly fishermen, including the current and historical distribution and relative abundance of key species, such as queen conch, spiny lobster, reef fish such as snappers, groupers, and large parrotfishes, and pelagic species such as tunas. Fishermen were also asked about current and historical spawning aggregation sites.

Socioeconomic Assessments

Meetings with Archipelago residents were held to document their use of the marine environment. Information gathered included the geographic distribution and relative intensity of marine tourism activities (*e.g.*, scuba diving, snorkeling, glass-bottom boats, jet skis, tours) and fishing. Stakeholders were asked about seasonal use patterns and the economic value of their activities.

Fishermen and marine tourism operators were also asked to identify specific locations most critical for their activities, as well as locations they may be prepared to stop using to advance conservation and management objectives.

MPA Design

Stakeholder were consulted initially on four planned MPAs: one around San Andrés Island and adjacent reef systems; one around Old Providence and Santa Catalina Islands, including the nearby barrier reef; one around Southwest and East Southeast Cays; and one around Quitasueño, Roncador and Serrana Banks and surrounding deeper waters. Collectively, the four planned MPAs covered over 10,000 km^2.

Stakeholder views were also sought on the most appropriate use of the five types of zones planned for the most intensively used waters of the Archipelago:

i) No-entry zones, allowing only research and monitoring by permission.
ii) No-take zones, open to non-extractive activities only.
iii) Artisanal fishing zones, open to artisanal fishing by traditional fishermen only.
iv) General use zones, open to all allowable activities but with conditions imposed to protect the environment and ensure ecological sustainability.
v) Special use zones, for areas requiring special management arrangements, such as the port and areas of high vessel traffic.

Financing

Effective MPA management requires funding to cover capital and start-up costs (*e.g.*, vessels, buoys) as well as annual operating costs. CORALINA and The Ocean Conservancy conducted a detailed study to estimate the annual operating costs of the MPAs, once established, and identify and evaluate possible financing mechanisms. As part of this work, tourists, tourism operators, fishermen, and members of the general public were asked about their willingness to pay some of the financial costs of operating the MPAs.

RESULTS

Stakeholder Engagement

CORALINA identified 81 organizations and institutions as users of the marine environment, including fishermen, watersports businesses, marinas, water taxis, tourism associations, government offices, environmental NGOs, and native rights groups (Howard et al. 2003). Identified users were categorized as fishers, recreational users, traditional users, conservation interests, educational institutions with resource management programs, and departmental and national government agencies. Working groups were then set up in each category with one member per constituent organization. Between 50 and 70 meetings have been held with user groups each year. Although many stakeholders participated, the groups most actively involved were artisanal fishermen and watersports operators (Howard et al. 2003).

Almost all stakeholders support the MPAs, including establishment of no-fishing, no-entry, and artisanal fishing zones. In a survey of 100 artisanal fishermen and 26 watersports businesses, most believed the MPAs would benefit them (96 % and 81 %, respectively). Accordingly, support for strong conservation measures was widespread. For example, 97 % of the artisanal fishers surveyed believed the MPAs should have zones closed to fishing, including some areas they currently fish (Howard et al. 2003).

Ecological Assessments

The first ecological assessment was conducted in July 2000 around Old Providence and Santa Catalina Islands and along the barrier reef. Teams focused on benthos or fish, and sampled 24 sites in three exposure regimes (windward, leeward, and lagoon) and seven major habitat types (patch reefs, reef slope, reef crest, forereef, mangrove, seagrass, and gorgonian)(Friedlander et al. In press). For the next assessment, conducted in December 2000 around San Andrés Island, fish and benthos teams sampled 15 sites with the same exposure regimes and four major habitat types (lagoon patch reefs, reef slope, gorgonian reef, and forereef)(Friedlander et al. In prep). In both areas, benthic community characteristics and fish assemblages were closely linked to the major habitat types in which they were found.

Overall, coral reef ecosystems around the islands seemed relatively

healthy. Around San Andrés, some degradation of nearshore habitats was found and attributed to sewage discharge, cay armoring, harbor development, tourist development, and pollution. Both assessments found conch, spiny lobster, and shallow-water grouper and large parrotfish (*e.g.*, blue parrotfish, *Scarus coeruleus*, midnight parrotfish, *Scarus coelestinus*), apparently depleted due to overfishing (Friedlander et al. In prep).

During the September 2002 assessment of the southern cays, Southwest and East Southeast Cays, 39 sites were sampled on each reef complex (Caldas et al. 2002). As part of this assessment, six local artisanal fishermen familiar with the area joined the biologists to ensure key fishing locations were sampled and to assist with data collection. Overfishing was evident, particularly of conch, spiny lobster, and reef fish. Several locations of particular conservation interest were identified, including conch spawning sites, healthy stands of *Acropora palmata*, and some areas of high species richness.

The April-May 2003 assessment of the northern cays, Quitasueño, Roncador and Serrana Banks, again used benthos and fish teams, and added a conch team, as conch are a resource of particular concern in this area. Artisanal fishermen from Old Providence also participated, providing detailed knowledge of the area and its resources and assisting with some aspects of data collection. In total, 124 sites were sampled for fish and benthos and 161 for conch. Although sites surveyed generally seemed healthy compared to many other Caribbean locations, populations targeted by fisheries appeared depleted. For example, relatively low abundance, biomass, and/or mean size of species such as large groupers (and snappers), was noted, particularly around Quitasueño (Dahlgren et al. 2003). Conch populations on all banks have been significantly reduced by fishing, with the population on Quitasueño particularly low (Appeldoorn et al. 2003b). Coral assemblage characteristics (e.g., coral cover and species, octocoral density and diversity) were within the ranges of the best conserved reefs in the Caribbean, but areas of high algal cover and coral disease outbreaks were also found (Sánchez et al. In prep).

Fishermen considered queen conch to be the most overfished resource in the Archipelago (Friedlander et al. In press). Spiny lobster and large parrotfishes were also considered overfished. Fishermen identified spawning aggregation sites around the inhabited islands and in the northern cays, including aggregation sites around Old Providence and Santa Catalina for Nassau, black, and yellowfin (*Mycteroperca venenosa*) groupers. Fishermen reported that the aggregations have been fished for many years and that the abundance and size of these species have declined over time.

Socioeconomic Assessments

The Archipelago's general population is characterized by a high unemployment rate (40 % or higher) and low income (van't Hof and Connolly 2002). Tourism in the Archipelago is an important industry and is focused on the marine and coastal environment. Most visitors engage in a marine activity, such as a glass-bottom boat ride, tour, water taxi to nearby cay, watercraft rental, snorkeling or diving.

In 1999, there were 369,256 tourist visitors to San Andrés and 17,692 to Old Providence. Reliable figures were difficult to obtain, but it has been

estimated that tourism accounts for 70 % or more of employment on San Andrés and 10 % on Old Providence. The tourism sector is estimated to contribute approximately 20 % of the Archipelago's gross domestic product (van't Hof and Connolly 2002).

Fishing, especially artisanal fishing, is a very important activity in the culture of native islanders, and is often a tradition passed from one generation to the next. Artisanal fishermen are estimated to number 200 - 500 individuals on San Andrés, and over 200 on Old Providence. Many artisanal fishermen sell a portion of their catch to a cooperative, to a middleman, or to the community directly, and most supplement their fishing income with farming or other activities (van't Hof and Connolly 2002).

Most industrial fishing in the Archipelago is by vessels from the Colombian mainland, from Central America, or from other Caribbean nations. However, some vessels in the Archipelago are licensed to conduct industrial fishing. In 2000, 49 vessels had such licenses (van't Hof and Connolly 2002). Little information was available on the economic value of this activity.

MPA Design

During consultations, stakeholders and CORALINA agreed on the following objectives for the MPAs:

i) Preservation, recovery, and long-term maintenance of species, biodiversity, ecosystems and other natural values including special habitats.
ii) Promotion of sound management practices to ensure long-term sustainable use of coastal and marine resources.
iii) Equitable distribution of economic and social benefits to enhance local development.
iv) Protection of the rights pertaining to historical use.
v) Education to promote a sense of stewardship and community involvement in management.

To better fulfill these objectives, the proposed number and external boundaries of MPAs were changed, increasing the total area covered to over 40,000 km^2 (Figure 1). Three MPAs are now planned: the 8,930 km^2 southern MPA around San Andrés Island and the southern cays; the 9,077 km^2 central MPA surrounding Old Providence and Santa Catalina Islands and deeper waters to the north and east; and the 23,512 km^2 northern cays MPA. This arrangement includes deepwater habitats previously excluded and recognizes the unique status of the northern cays, which are subject to a fishing treaty between Colombia and the U.S.

Development and refinement of zoning alternatives proceeded in a stepwise, iterative fashion, beginning with the waters around the inhabited islands. Initial zoning proposals by stakeholder groups provided inadequate protection for key habitats and had other ecological shortcomings (e.g., Friedlander et al. In press), as well as often being impractical (e.g., too complex to enforce) or unacceptable to other groups. Zoning alternatives were improved in subsequent meetings, including through injection of additional ecological information as it became available from the assessments. By November 2003, zoning plans for San Andrés, Old Providence and Santa

Catalina were close to final (Figures 2 and 3). Zoning for the southern and northern cays has begun, and is expected to proceed more quickly as a result of experience gained.

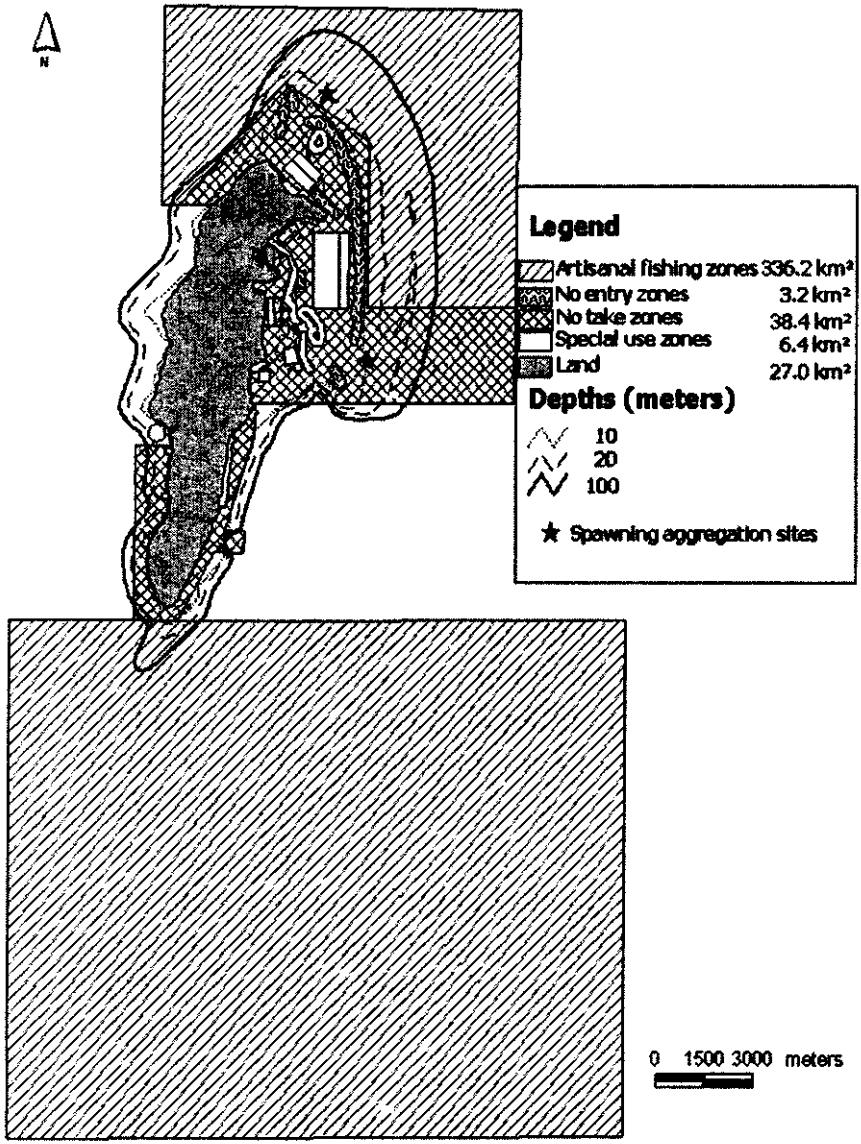

Figure 2. Zoning plan for the waters around San Andrés Island.

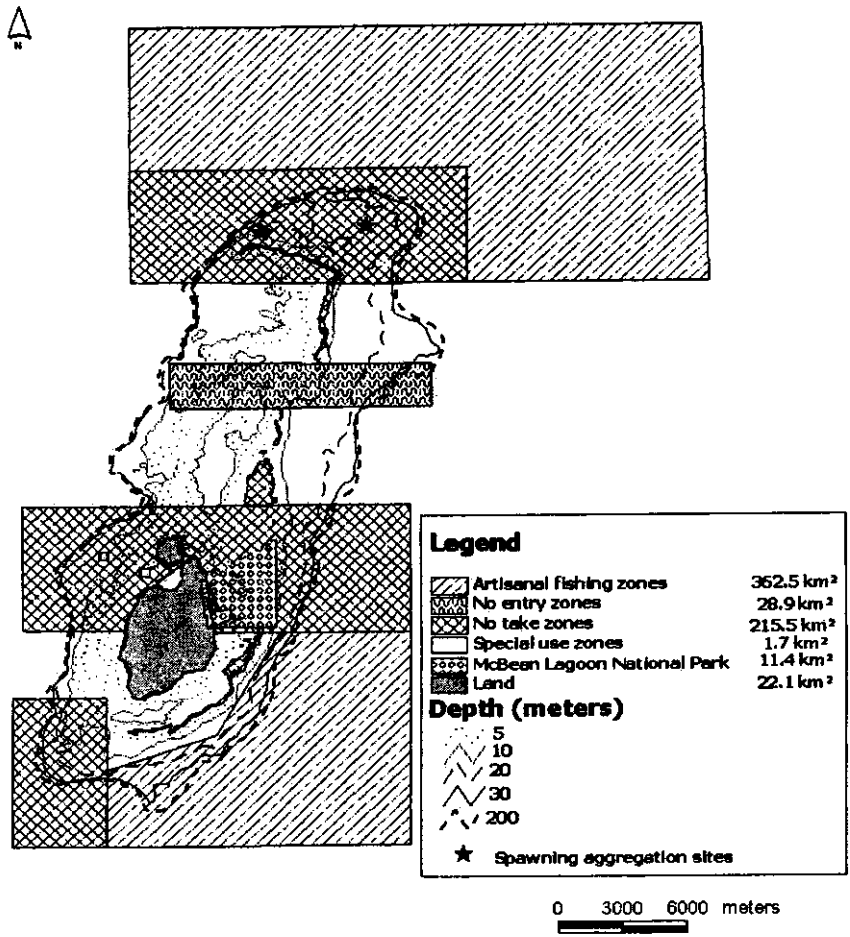

Figure 3. Near-final zoning plan for the waters around the islands of Old Providence and Santa Catalina. Old Providence is the larger island. The national park is closed to fishing.

Financing

The annual costs of operating the MPAs optimally, including costs of personnel, maintenance, surveillance and patrolling, education, and monitoring, were estimated at US$ 350,000 (van't Hof and Connolly 2002). Initial capital expenditures (for radios, cameras, etc., but excluding vessels, which CORALINA already possesses,) were estimated to require an additional US$ 34,000. These figures exclude the management requirements of the northern cays, which will depend on both local and international arrangements and cannot yet be reasonably estimated (van't Hof and Connolly 2002).

Twenty potential funding sources were identified and evaluated. Legal, cultural or practical considerations eliminated seven, including lotteries, leases and concessions, and local or national individual or corporate donations. Many of the remaining mechanisms were judged to have reasonable potential, including multilateral donors, bilateral development agencies, international conservation and development organizations, and debt for nature swaps (van't Hof and Connolly 2002).

Options judged most promising included a tourist tax, an MPA user fee, and a resource extraction fee. Colombian law provides for a tourist tax, a portion of which is designated for preservation of natural resources. Tourists entering the Archipelago are required to purchase tourist cards. Given that 300,000 to 400,000 tourists visit the Archipelago annually, it should be both legally and practically feasible to add a small additional tax to help support the MPAs. Another option is an environmental stamp that visitors to the MPA must purchase, for example when embarking on a cruise. Industrial and artisanal fishing requires licenses; it may be possible also to levy a fee for resource extraction (van't Hof and Connolly 2002).

Considerable willingness exists among both the local population and visitors to make a financial contribution to the MPAs (van't Hof and Connolly 2002). For example, 72 % of 140 randomly selected households in San Andrés were willing to pay a monthly assessment for coral conservation (Howard et al. 2003). Fishermen are also willing to pay a user fee (van't Hof and Connolly 2002).

DISCUSSION

Much has been written about the requirements for establishing successful MPAs (e.g., Agardy 1997, Gubbay 1995, Kelleher and Kenchington 1992, Salm et al. 2000). Oft-cited elements include adequate ecological and socioeconomic information, meaningful stakeholder participation, adequate legal framework, sufficient compliance and enforcement, and adequate management and financial resources. The Seaflower Biosphere Reserve MPA project addresses all of these elements. In the project's first three years, emphasis has been placed on establishing and strengthening relationships between CORALINA and the community, particularly artisanal fishermen and the marine tourism sector, gathering ecological and socioeconomic information, and zoning.

The result has been persistently high levels of community support for the planned MPAs, notably among fishermen and marine tourism operators,

despite future loss of access to previously used locations. This support has translated into a planned MPA system nearly four times larger than originally proposed, and zoning plans including substantial no-fishing (no-entry and no-take) zones protecting examples of all major habitat types. Because of the strong relationship between habitat types and associated species, adequate representation of the identified habitat types in no-fishing zones should ensure representation of major benthic communities and reef-fish assemblages, and therefore include most species in the management area throughout their life cycles (Friedlander et al. in press).

In addition to protecting representative habitats, it is also important to protect ecological connectivity among habitats (Appeldoorn et al. 2003a). For example, many reef fish make ontogenetic migrations, with mangrove, shallow seagrass and shallow rocky shoreline habitats serving as settlement and nursery areas and reefs as adult habitat. The planned no-fishing zones are relatively large and in many cases extend from shore to offshore waters, encompassing multiple habitat types, so ecological connectivity among habitats should be protected.

The Seaflower Biosphere Reserve MPA project is at a critical point, poised to establish an extensive marine and coastal protected areas system with ecologically and socioeconomically sound zoning schemes that are culturally appropriate. It is important that the MPAs be legally declared soon and zoning plans finalized and implemented, to allow the transition from design and establishment to management. CORALINA, stakeholders, and partners must focus next on securing funding to support full implementation and cover recurrent operating costs, establishing effective community advisory bodies, and implementing effective monitoring, evaluation, compliance and enforcement programs.

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